INSTRUCTION MANUAL

B+K PRECISION 280

ROCKFORD INSTRUMENT LAB
1718 Broadway
Rockford, IL 61108

3-DIGIT DIGITAL MULTIMETER

B+K PRECISION

Product of DYNASCAN CORPORATION
1801 West Belle Plaine Avenue, Chicago, Illinois 60613

WARRANTY

"B&K-Precision warrants that each product manufactured by it will be free from defects in material and workmanship under normal usage and service for a period of one year after its purchase new from an authorized B&K-Precision distributor. Our obligation under this warranty is limited to repairing, or replacing any product or component which we are satisfied does not conform with the foregoing warranty and which is returned to our factory or our authorized service contractor, transportation prepaid, and we shall not otherwise be liable for any damages, consequential or otherwise. *The foregoing warranty is exclusive and in lieu of all other warranties (including any warranty of merchantability), whether expressed or implied.* Such warranty shall not apply to any product or component (i) repaired or altered by anyone other than B&K-Precision or its authorized service contractor without B&K-Precision's prior written approval; (ii) tampered with or altered in any way or subjected to misuse, negligence or accident; (iii) which has the serial number altered, defaced or removed; or (iv) which has been improperly connected, installed or adjusted otherwise than in accordance with B&K-Precision's instructions. B&K-Precision reserves the right to discontinue any model at any time or change specifications or designs without notice and without incurring any obligation. *The warranty shall be void and there shall be no warranty of any product or component if a B&K-Precision warranty registration card is not properly completed and postmarked to the B&K-Precision factory within ten days after the purchase of the product new from an authorized B&K-Precision distributor.*"

B&K-PRECISION MODEL 280 PARTS LIST

488-152-9-002 B

SCHEMATIC SYMBOL	DESCRIPTION	PART NO.
	RESISTORS	
R6	0.098Ω, Preformed Wirewound	004-125-9-001
R7	0.9Ω, 1/2W, 1% Preformed Wirewound	004-147-9-001
R8	9Ω, 1/2W, 1% Preformed Metal Film	011-072-9-001
R9	90Ω, 1/2W, 1% Preformed Metal Film	011-073-9-001
R10	470kΩ, 1/2W, 5% Preformed Metal Film	011-102-8-474
R11	4.99mΩ, 1/4W, 1% Preformed Metal Film	011-079-9-001
R12, 14	49.9kΩ, 3W, 1% Metal Film	011-085-9-001
R13	499Ω, 1% Preformed Thick Metal Film	004-149-9-001
R15	3.6kΩ, 3W, 5% Special Metal Glaze	004-151-9-001
	Units with Vertical Trimpots (Under Serial #39-03500)	
R21	Trimpot, 5k Ω	008-219-9-001
R22	Trimpot, 100kΩ	008-221-9-001
R23	Trimpot, 250Ω	008-222-9-001
R24	Trimpot, 30kΩ	008-220-9-001
R25	100Ω, 30% 25 Turn Pot	008-218-9-001
	Units with Horizontal Trimpots (Above Serial #39-03500)	
R21	Trimpot, 5kΩ	008-231-9-001
R22	Trimpot, 100kΩ	008-228-9-001
R23	Trimpot, 250Ω	008-229-9-001
R24	Trimpot, 30kΩ	008-230-9-001
R25	100Ω, 30%, 25 Turn Pot	008-218-9-001

Composite
499-076-9-001 C

SCHEMATIC SYMBOL	DESCRIPTION	PART NO.
	NETWORKS	
RN1	Resistor Network	012-005-9-001
RN2	Resistor Network	012-003-9-001
RN3	Resistor/Capacitor Network	012-004-9-001
RN4	Resistor Network	012-002-9-001
RN5	Resistor Network	012-006-9-001
	CAPACITORS	
C1	.01μfd, 600V, 20% Preformed Polyester	025-066-9-001
C2, C13	.047μfd, 100V, 10% Polyester	025-096-9-001
C3, 4, 5, 6	10μfd, 16V, 20% Preformed Tantalum	027-010-9-001
C7	15μfd, 10V, 20% Preformed Tantalum	027-009-9-001
C8	270pfd, 500V, 10% Pin Lead Ceramic Disc	020-137-9-001
C9	.033μfd, 100V, 10% Molded Polyester	025-095-9-001
	INDUCTORS	
L1	560μhy Inductor	041-067-9-001
	DIODES & TRANSISTORS	
CR1, 2, 17	1A, 600V Silicon Diode	151-018-9-001
CR3 thru CR11	1N4148 Silicon Diode	151-038-9-001
CR12	1N4736, 6.8V, 1W, 10% Zener Diode	152-061-9-001
CR13	1N4742A, 12V, 1W, 5% Zener Diode	152-039-9-001
CR14	7.5V, 500mW, Zener Diode	152-068-9-001
CR15	1N749A, 4.3V, 500mW, 5% Zener Diode	152-062-9-001

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CR15	1N749A, 4.3V, 500mW, 5% Zener Diode	152-062-9-001

DESCRIPTION	PART NO.
Foot, 7/16 Dia.	380-120-9-001
Filter, Display (Plastic	380-230-9-001
10 Lead Jumper	427-014-9-001
Black Test Lead (Banana-to-Insulated Clip)	522-062-9-001
Red Test Lead (Banana-to-Probe)	522-063-9-001
Negative Jack/Fuse Holder Assembly	523-115-9-001
Knob, Switch (Function and Range)	751-119-9-001
Contact Fuse (P.C.B. Mount)	763-041-9-902
Spring, Battery Jumper/Contact	769-081-9-001
Contact, Battery (Single)	769-080-9-001
Mask, Minus Sign	769-077-9-001
Phone Jack, Sub-Miniature	773-059-9-001
Nut for Phone Jack, Sub-Miniature	653-018-9-001
Insulator, Vinyl, for Phone Jack	342-030-9-001

NOTE: Standard value resistors are not listed. Values may be obtained from schematic diagram. Minimum charge $5.00 per invoice. Orders will be shipped C.O.D. unless previous open account arrangements have been made or remittance accompanies order. Advance remittance must cover postage or express charges. Specify serial number when ordering replacement parts.

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INTRODUCTION

The B & K-Precision Model 280 Digital Multimeter is a significant contribution to the instrumentation market. Low cost and high performance have been engineered into this instrument to make available to the engineer, technician, maintenance and service personnel, and training institutions a digital multimeter that is competitively priced with existing analog meters and which, at the same time, exceeds the performance of these meters. In addition, the basic instrument has been designed for maximum simplicity of operation and minimum error of reading.

The basic design features of this instrument make it an ideal replacement for existing multimeters and FET/VOM's. The instrument measures DC and AC voltage, current and ohms. It has high input impedance (10 megohms) on all voltage ranges, and a wide resistance measurement range (100 ohms full range to 10 megohms full range). In addition to providing equivalent functions and ranges, the inherent accuracy of this instrument provides a significant margin of improved performance over analog multimeters.

A HI/LO Ohms feature, generally not available on digital multimeters, permits making in-circuit resistance measurements at voltage levels below the threshold conduction of semiconductors.

The overload protection system was designed to provide maximum protection of the instrument with minimum user inconvenience, in the event of extreme overload accidents.

SPECIFICATIONS

DC VOLTAGE

Ranges:	±0-1ooomV, 10V, 100V, 1000V.
Accuracy, +25°C, ±1°C:	±.5% of reading, ±0.5% of full range, ±1LSD, 1ooomV, 10V, 100V ranges.
	±1.0% of reading, ±0.5% of full range, ±1 LSD, 1000V range.
Temperature Coefficient, +15°C to +35°C:	±.025%/°C.
Input Impedance:	10 megohms.
Polarity Indication:	Automatic; minus sign shown, plus sign implied.
Circuit Protection, All Voltage Ranges:	±1000VDC or AC RMS.

AC VOLTAGE

(Average reading circuitry calibrated to read RMS value of pure sine wave.)

Ranges:	0-1ooomV, 10V, 100V, 1000V.
Accuracy, +25°C, ±1°C:	±1.0% of reading, ±1.0% of full range, ±1 LSD, 1ooomV, 10V, 100V ranges.
	±2.0% of reading, ±1.0% of full range, ±1 LSD, 1000V range.
Temperature Coefficient, +15°C to +35°C:	±.025%/°C.
Frequency Response:	50-200 Hz.
Input Impedance:	10 megohms.
Circuit Protection, All Voltage Ranges:	±1000VDC or AC RMS.

DC CURRENT

Ranges:	0-1000μA, 10mA, 100mA, 1000mA.
Voltage Drop (Measured at Instrument Terminals);	Nominal 100mV full range, 1000μA, 10mA, 100mA ranges.
	Nominal 300mV full range, 1000mA ranges.
Accuracy, +25°C, ±1°C:	±1.0% of reading, ±1.0% of full range, ±1 LSD, 1000μA, 10mA, 100mA ranges
	±2.0% of reading, ±1.0% of full range, ±1 LSD, 1000mA range.
Temperature Coefficient, +15°C to +35°C:	±.05%/°C.
Polarity Indication:	Automatic; minus sign shown, plus sign implied.
Circuit Protection, All Ranges:	Fuse and diodes. Fuse externally accessible.

AC CURRENT

Ranges:	0-1000μA, 10mA, 100mA, 1000mA.
Voltage Drop (Measured at Instrument Terminals):	Nominal 100mV RMS full range, 1000μA, 10mA, 100mA ranges.
	Nominal 300mV RMS full range 1000mA range.
Accuracy, +25°C, ±1°C:	±1.0% of reading, ±1% of full range, ±1 LSD, 1000μA, 10mA, 100mA ranges.
	±2.0% of reading, ±1% of full range, ±1 LSD, 1000mA range.
Temperature Coefficient, +15°C to +35°C:	±.05%/°C.
Frequency Response:	50-200 Hz.
Circuit Protection, All Ranges:	Fuse and diodes. Fuse externally accessible.

RESISTANCE

Ranges:	0-100Ω, 1000Ω; 10kΩ, 100kΩ, 1000kΩ; 10MΩ.
Polarity:	Plus (+) jack is positive for all ranges.
Accuracy, 25°C, ±1°C:	±1.0% of reading, ±1% of full range, ±1 LSD, 100Ω, 1000Ω, 10k, 100k, 1000kΩ ranges.
	±1.5% of reading, ±1% of full range, ±1 LSD, 10MΩ range.
Temperature Coefficient, +15°C to +35°C:	±.05%/°C
Test Currents:	100 Ω 1mA Lo (100mV, full range) 1000 Ω 1mA Hi (1V, full range) 10kΩ 10μA Lo (100mV, full range) 100kΩ 10μA Hi (1V, full range) 1000kΩ 100nA Lo (100mV, full range) 10MΩ 100nA Hi (1V, full range)
Circuit Protection:	1000kΩ and 10MΩ: Continuous ±1000VDC or AC.
	10kΩ and 100kΩ: Continuous ±400VDC or AC. Will withstand momentary overloads to ±1000VDC or AC.
	100Ω and 1000Ω: Continuous ±125VDC or AC. Will withstand momentary overloads to ±1000VDC or AC.

GENERAL

Operating Temperature	0°C to +50°C.
Overrange Indication, All Ranges and Functions:	The display will flash when the input exceeds the value of the range selected.
Settling Time, All Ranges and Functions:	Less than one second, typically .5 second.
Power Source:	4 "C" size batteries, Ni-Cad, Alkaline or Carbon Zinc, with provision for charger/converter. (NOTE: Batteries or charger/converter are *not supplied.)*
Battery Life:	Better than 50 hrs. (with Alkaline batteries, continuous use).
Accessories (Included):	2 test leads.
Dimensions:	4-3/8" W x 6-3/8" H x 2" D.
Weight:	2 lbs.

CONTROLS AND FEATURES

FUNCTION SWITCH. Selects the type of measurement to be performed.

(+) JACK. "Hot" input jack. In voltage measurements the test lead connected to this jack is normally applied to the potential point in the circuit most removed from signal ground or earth ground.

(-) JACK. Common connection to the instrument input; it should be connected to ground or a low impedance point when measuring voltage. The jack doubles as the 1A 7AG fuse holder.

HI LO OHMS INDICATION WINDOW. Shows H or L, depending on the range selected.

POWER SWITCH. Turns unit ON or OFF.

RANGE SWITCH. Selects the desired range for the measurement.

ZERO ADJUSTMENT. Sets zero on the display for any range or function.

BATT. TEST. Test point at right side of case provides battery test, using the (+) test probe.

CHARGER-CONVERTER JACK. Provides rapid connection to charger-converter.

MINUS SIGN. A minus ( ) indication will be displayed on DC Volts or DC current for a negative voltage or current respectively. NOTE: The positive(+) sign is implied and is not displayed.

NUMERICAL READOUTS. Three-digit display. Each display indicates numerals from "0" to "9". Also serves as overrange indicator by flashing all three displays when input exceeds value of 999.

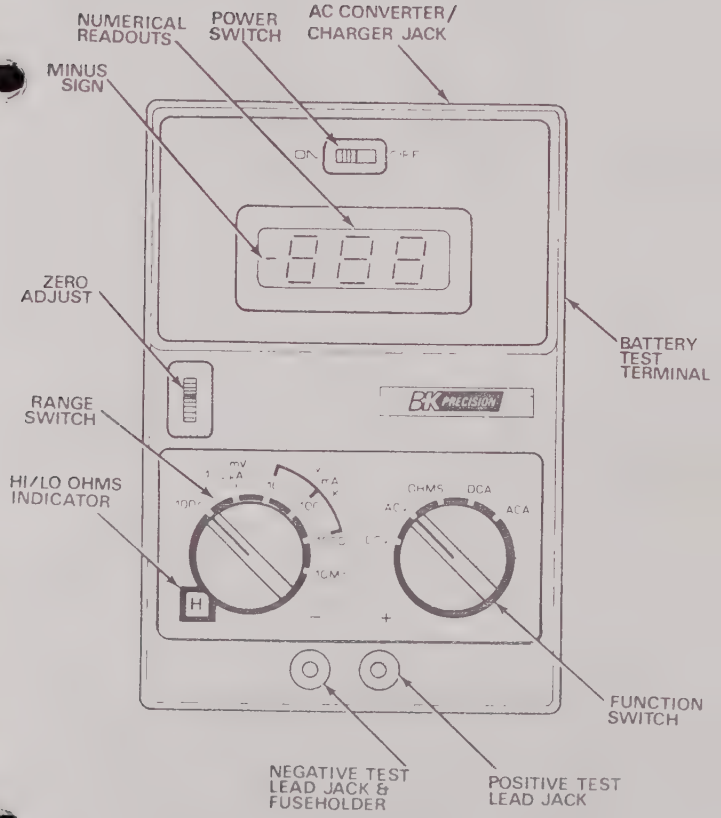


Fig. 1. Controls and indicators.

OPERATION

1. BATTERY OPERATION WITH NON-RECHARGEABLE CARBON-ZINC OR ALKALINE CELLS

The 280 will operate from 4 "C" size flashlight batteries. Install as shown in MAINTENANCE section on page 22.

AC-POWERED CHARGER/CONVERTER USE

B & K-Precision Model BC-28 is recommended. The charger/converter is designed for use with "C" size Ni-Cad batteries. It plugs into the jack located as shown in Fig. 1. For proper operation, the 280 *must have batteries installed* to use the charger/converter.

WARNING: Do NOT attempt to use the AC Charger/Converter to charge carbon-zinc or alkaline batteries.

2. PREPARATION AND CHECK

a. Plug the red test lead into the (+) jack, and the black test lead into the (–) jack.

b. Turn unit on.

c. Turn the FUNCTION switch to OHMS.

d. Without a resistance connected across the test leads, the overrange indication should occur, causing the display to flash. Shorting the test lead should produce a zero reading.

e. Return FUNCTION Switch to ACV or DCV and RANGE Switch to 1000V. It is good practice to leave the instrument in this position when not in use to prevent accidental overloads.

SAFETY PRECAUTIONS

A certain amount of danger is always present when working on electrical equipment, and therefore, the user is cautioned to always familiarize himself as much as possible with the equipment to be tested, before any work is performed. It should be kept in mind that high voltages often appear at unexpected points in defective equipment.

When testing high voltage circuits, develop the habit of keeping one hand in your pocket to minimize the hazard of accidental shock. It is also important to have a properly insulated floor or floor covering to stand on while taking measurements. Be particularly careful to avoid contact with nearby objects which could provide a ground return path.

It is good practice to *remove operating power* before connecting test leads. An isolation transformer always should be used in equipment having the chassis tied to one side of the AC power line.

3. BATTERY TEST

a. Set to 10V DC Range. Insert positive (+) test lead probe into battery test terminal on right side of case.

BATTERY TYPE	READING	CONDITION
ZINC-CARBON OR ALKALINE	001 or greater	Battery OK
	000 or minus	Replace
NI-CAD	090 or less	Recharge

NOTE

Discharge of Ni-Cad batteries below the reading of 090 will reduce the rechargeable life of the batteries.
Remove discharged carbon-zinc or alkaline batteries immediately to prevent leakage damage to the case.

b. Replacement of batteries. Loosen the captive screw on the back cover (Fig. 3). Replace with "C" cells. Although carbon-zinc batteries can be used, alkaline or nickel cadimum (rechargeable) are recommended (see Maintenance Section for replacement battery type numbers). The battery polarity is marked in the battery holder. Replace cover and tighten screw.

TABLE 1

INTERPRETATION OF DIGITAL DISPLAY READINGS

TO MEASURE	SET FUNCTION SWITCH	SET RANGE SWITCH	DISPLAY FULL RANGE*	READINGS ARE IN:	RESOLUTION**
DC VOLTS					
0-1 V	DCV	1000mV	999	mV	1 mV
0-10V		10 V	9.99	Volts	10 mV
0-100V		100 V	99.9	Volts	0.1 V
0-1000 V		1000 V	999	Volts	1.0 V
AC VOLTS					
0-1 V	ACV	1000 mV	999	mV	1 mV
0-10 V		10 V	9.99	Volts	10 mV
0-100 V		100 V	99.9	Volts	0.1 V
0-1000 V		1000 V	999	Volts	1.0V
DC CURRENT					
0-1 mA	DCA	1000 μA	999	μA	1 μA
0-10 mA		10 mA	9.99	mA	10 μA
0-100 mA		100 mA	99.9	mA	100 μA
0-1 Amp		1000 mA	999	mA	1 mA
AC CURRENT					
0-1 mA	ACA	1000 μA	999	μA	1 μA
0-10 mA		10 mA	9.99	mA	10 μA
0-100 mA		100 mA	99.9	mA	100 μA
0-1 Amp		1000 mA	999	mA	1 mA
OHMS					
0-100 Ω	OHMS	100 Ω	99.9	Ohms	0.1 Ω
0-1000 Ω		1000 Ω	999	Ohms	1 Ω
0-10 kΩ		10 kΩ	9.99	Kilohms	10 Ω
0-100 kΩ		100 kΩ	99.9	Kilohms	100 Ω
0-1 MΩ		1000 kΩ	999	Kilohms	1 kΩ
0-10 MΩ		10 mΩ	9.99	Megohms	10 kΩ

NOTES

Do not exceed input levels of 1000V AC or DC.

*The overrange will be accurate to the 1020 count; however, the display will flash and the highest digit "1" will not be displayed.

**Resolution indicates the change in the measured value that is required to shift the least significant (right hand) digit, one count.

TABLE 1 is provided as an aid to operation of the Model 280 and, in addition, provides interpretation of the displays obtained. Note that the decimal location changes with the position of the RANGE switch. The significance of the decimal location must be known to assure proper interpretation of the readings obtained.

4. DC VOLTAGE MEASUREMENTS

a. Set FUNCTION switch to the DCV position.

b. Short the test leads and zero the instrument by turning the ZERO control until the MINUS sign just lights or flickers with a zero reading displayed.

c. Set RANGE switch as required for the voltage amplitude to be measured. If the magnitude of the voltage is not known, set the RANGE switch to the highest position and reduce the settings as required to obtain a satisfactory reading.

d. If the voltage exceeds that of the range selected, the overrange indication will operate and the digits will flash. Select a higher voltage range.

5. AC VOLTAGE MEASUREMENTS

a. Place the FUNCTION switch in the ACV position.

b. Set the RANGE switch to the desired voltage range. If the voltage exceeds that of the range selected, the overrange indication will operate and the digits will flash. Select a higher voltage range.

6. RESISTANCE MEASUREMENTS

CAUTION

Do not attempt to measure resistance in a circuit in which the power is applied. Remove the power and make sure that all capacitors are discharged before attempting in-circuit resistance measurements.

a. OUT-OF-CIRCUIT:

(1). Set the FUNCTION switch to the OHMS position.

(2). Set the RANGE switch to the desired position.

(3). If the resistance value being measured exceeds the value of the range selected, the overrange circuitry is energized, causing the digits to flash. Select a higher range.

NOTE

If accidentally connected to a power source greater than 125V while in the 100Ω or 1000Ω range, it is possible that the internal protection fusible resistor will open. This may be easily verified by connecting the test leads to a resistor of about 820Ω while on the 1000Ω range. If the protection resistor is open, the reading will be near zero. Refer to Maintenance Section for service information.

b. IN-CIRCUIT:

(1). The Model 280 alternates between LO and HI ohms ranges. Conventional resistance measurements can be performed on all ranges. The LO ohms positions limit the maximum test voltage developed across the measured resistance to .1 volt with a full range reading. This low voltage permits accurate measurements of in-circuit resistances shunted by semiconductor junctions.

The applied test voltage is proportional to the resistance reading observed, varying from zero with the test leads shorted to .1 volt for a full range reading. For example, in the 100Ω range with a resistance reading of 50.0 ohms, the voltage developed across the resistance under test is .05 volt.

When using the HI ohms positions, a full-range voltage of 1 volt is developed across the measured resistance. Again, the voltage developed across the measured resistance is proportional to the resistance reading observed. Reversing the leads will result in the same reading (within 1%) if there is no shunting by a semiconductor, and is a good quick check that the accuracy of the measurement is not being affected by semiconductors.

c. OUT-OF-CIRCUIT SEMICONDUCTOR TESTS:

In addition to conventional resistance measurements, the HI ohms ranges can be used to verify that a semiconductor junction is good by checking the front-to-back ratio.

(1). Select the 1000Ω range.

(2). Remove device from circuit.

(3). Connect the test leads to the device (E.g., diode, base-emitter of base-collector junction) and then reverse the lead connections. Observe the meter reading for both conditions.

TEST RESULT	CONDITION
(a) Overrange, both polarities	Junction Open
(b) Zero or Low Reading, both polarities	Junction Shorted
(c) Overrange in one direction and In-Range Reading in the other	Junction probably good

(4). The in-range reading of Step (c) can be used to determine whether the device under test is silicon or germanium. A reading of 400 to 700 indicates the device is silicon. An indication of 100 to 300 indicates the device is germanium.

7. DC CURRENT MEASUREMENTS

a. Place the FUNCTION switch in the DCA position.

b. Place the RANGE switch to the desired current range position. Always set the RANGE switch to the highest position if the magnitude of current to be measured is not known.

CAUTION

Use care in making current measurements. Make sure that the meter is connected *in-series* with the load in which the current is to be measured. Never connect the meter across a voltage source with the FUNCTION Switch set for current. Doing so may either blow the overload protection fuse or damage the equipment under test.

When connecting the multimeter to read current, first remove power to the circuit. The following rules will insure that the proper current polarity is indicated.

(1). When inserting the multimeter between the positive side of the power source and the load, connect the positive lead to the power source and the negative lead to the load.

(2). When inserting the multimeter between the negative side of power source and the load, connect the negative lead to the power source and the positive lead to the load.

d. Apply power and read current.

e. If the polarity of the current being measured is negative, the polarity sensing current will be energized, and the value displayed will be preceded by a minus (–) sign.

f. If the magnitude of the current being measured exceeds that indicated on the RANGE switch, the overrange circuitry will operate, causing the digits to flash. When this occurs, immediately remove power from the circuit under test and select a higher current range before proceeding further.

NOTE

Current ranges are fuse protected. If inoperative refer to Maintenance Section for fuse replacement.

8. AC CURRENT MEASUREMENTS

a. Set the FUNCTION switch to the ACA position.

b. Set the RANGE switch to the desired position. If in doubt about the magnitude of the current to be measured, use the highest current range and then adjust the RANGE switch as required to obtain a satisfactory reading.

c. When connecting the multimeter for current measurements remove the power from the circuit being tested while the connections are being made. Reapply the power and read current.

d. If the magnitude of the current being measured exceeds the range selected, the overrange circuitry will operate, causing the digits to flash. When this occurs immediately remove power from the circuit under test and select a higher current range before proceeding further.

NOTE

Current ranges are fuse-protected. If inoperative, refer to Maintenance Section on replacement.

THEORY OF OPERATION

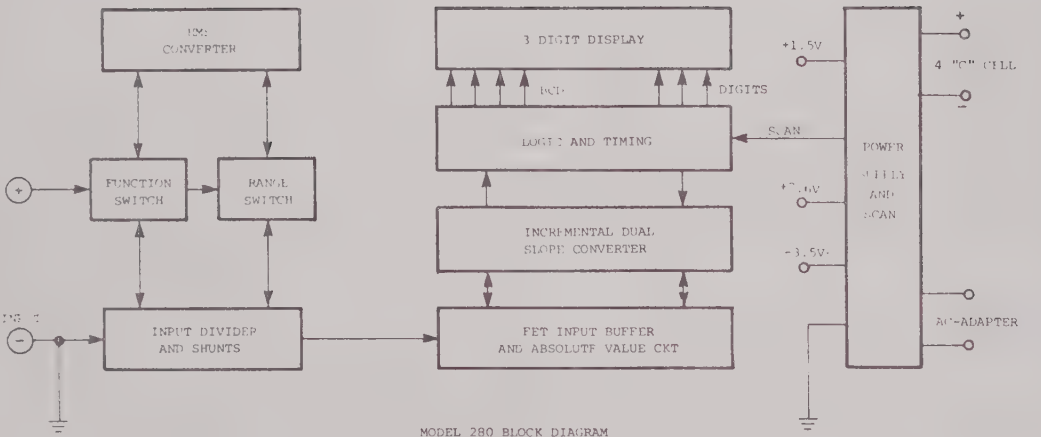
The basic functions of the 280 can best be described by referring to the block diagram, Fig. 2.

The input signal is routed via the FUNCTION and RANGE switch to the input attenuator or shunts so that a nominal 100mV is applied to the input of the FET buffer amplifier for a full scale input signal.

When the OHMS function is selected, either 100mV (LO Ω) or 1 volt (HI Ω) full scale is applied to the FET input depending on the RANGE that is selected. The test voltage is proportional to the resistance reading observed. For example, if LO ohms resistance range is selected, the voltage developed across the measured resistance is 50mV if a half-range reading is indicated.

The FET buffer is part of an absolute value circuit that "full-wave-rectifies" the input signal, filters the output and detects polarity. The resultant positive DC voltage is then applied to the Incremental Dual Slope Converter which generates a pulse rate that is proportional to the input voltage. These output pulses are gated into an event counter by a clock-derived time base so that the display is updated after every conversion.

The power supply is a "fly-back" type converter that is driven by the scan oscillator. The critical analog supply voltages are shunt stabilized, whereas the digital and display supply voltages are taken directly off the battery terminals.



MODEL 280 BLOCK DIAGRAM

Fig. 2.

MODEL 280 CALIBRATION PROCEDURE

(Refer to Fig. 5 for Location of Internal Adjustments)

The instrument should not require calibration unless repairs have been made that change the factory calibration. Prior to calibration the instrument should be checked for proper operation of all functions and for damage from physical abuse or excessive overloads.

The following procedure requires a low-impedance constant-voltage source of 0.1% accuracy or better. Use of sources with less accuracy reduces the accuracy of the instrument. Remove back and refer to Fig. 4.

It is important that this procedure is followed in the order given below:

1. Set unit to DCV, 1000mV scale, inputs shorted.
2. Turn R3, zero adjust control, so that the minus sign is just flickering, then turn so that the minus sign is off. (**NOTE:** If zero is not obtained within adjustment range of R3, unit is defective and cannot be calibrated.)
3. Apply +2mVDC to input and adjust R22 for a zero reading.
4. Apply +10mVDC and −10mVDC and check reading for symmetry. If readings are not symmetrical, adjust R3 until symmetry is obtained.
5. Apply +1 volt DC and −1 volt DC to input and adjust R23 so that the range error is split between polarities.
6. Set unit to OHMS, 100Ω scale; apply 90 ohms ±0.1%.
7. Adjust R24 for a 90.0 reading.
8. Set unit to 1kΩ scale, apply 900 ohms ±0.1%.
9. Adjust R21 for a 900 count reading.
10. Check all DCV, ACV, DCA, ACA and OHMS scales for correct readings.

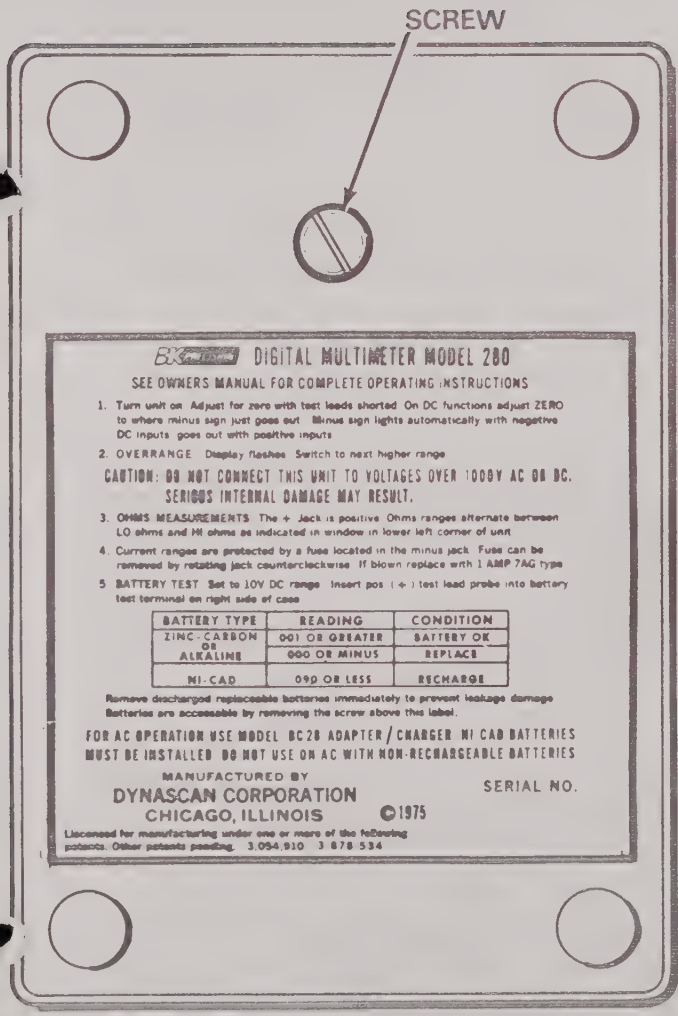

SCREW
B&K Precision DIGITAL MULTIMETER MODEL 280
SEE OWNERS MANUAL FOR COMPLETE OPERATING INSTRUCTIONS
1. Turn unit on Adjust for zero with test leads shorted On DC functions adjust ZERO to where minus sign just goes out Minus sign lights automatically with negative DC inputs goes out with positive inputs
2. OVERRANGE Display flashes Switch to next higher range
CAUTION: DO NOT CONNECT THIS UNIT TO VOLTAGES OVER 1000V AC OR DC. SERIOUS INTERNAL DAMAGE MAY RESULT.
3. OHMS MEASUREMENTS The + Jack is positive Ohms ranges alternate between LO ohms and HI ohms as indicated in window in lower left corner of unit
4. Current ranges are protected by a fuse located in the minus jack Fuse can be removed by rotating jack counterclockwise If blown replace with 1 AMP 7AG type
5 BATTERY TEST Set to 10V DC range Insert pos (+) test lead probe into battery test terminal on right side of case
BATTERY TYPE | READING | CONDITION
ZINC-CARBON OR ALKALINE | 001 OR GREATER | BATTERY OK
ZINC-CARBON OR ALKALINE | 000 OR MINUS | REPLACE
NI-CAD | 090 OR LESS | RECHARGE
Remove discharged replaceable batteries immediately to prevent leakage damage Batteries are accessable by removing the screw above this label.
FOR AC OPERATION USE MODEL BC 28 ADAPTER / CHARGER NI CAD BATTERIES MUST BE INSTALLED DO NOT USE ON AC WITH NON-RECHARGEABLE BATTERIES
MANUFACTURED BY
DYNASCAN CORPORATION
CHICAGO, ILLINOIS
©1975
SERIAL NO.
Licensed for manufacturing under one or more of the following patents. Other patents pending. 3,054,910 3 878 534

Fig. 3

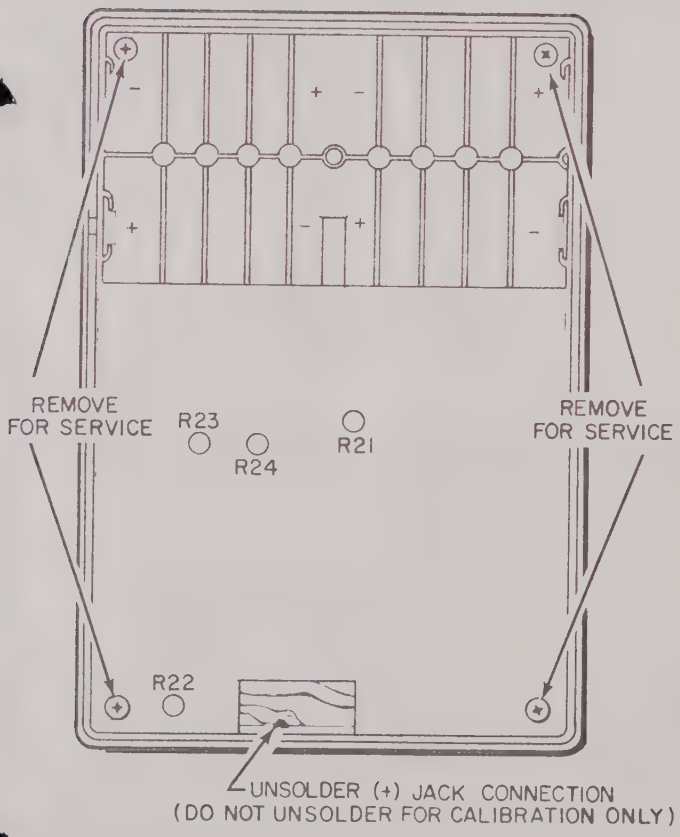

REMOVE
FOR SERVICE
R23
R24
R21
REMOVE
FOR SERVICE
R22
UNSOLDER (+) JACK CONNECTION
(DO NOT UNSOLDER FOR CALIBRATION ONLY)

Fig. 4.

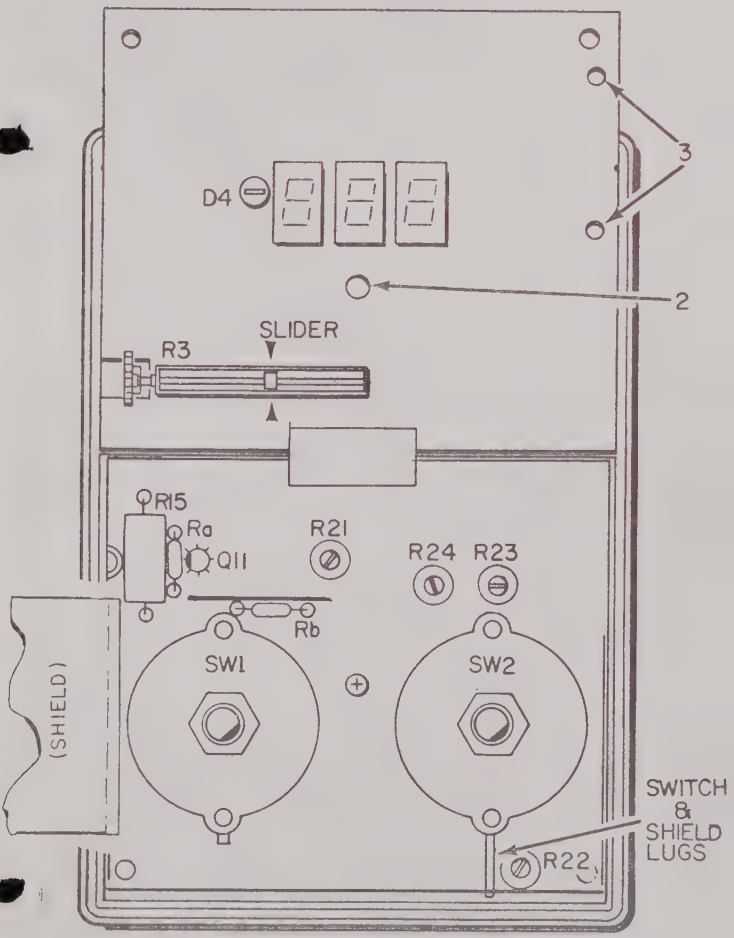

D4
3
2
SLIDER
R3
R15
Ra
Q11
R21
R24
R23
Rb
SW1
SW2
(SHIELD)
SWITCH
&
SHIELD
LUGS
R22

Fig. 5.

MAINTENANCE

FUSE REPLACEMENT

The negative jack is also a fuse holder. To replace fuse, turn the insert counterclockwise to remove the fuse. *Replace only with the proper 1A-7AG type fuse.* To re-assemble, insert new fuse, push in and turn the insert clockwise to the internal stop.

BATTERY REPLACEMENT

Loosen the captive screw in Fig. 3 and remove the back cover.

Install or replace the 4 "C" cells with the polarity as shown in the battery holder. Replace the back cover and tighten the captive screw.

Alkaline or Ni-Cad Batteries are recommended for this product. If Carbon-Zinc or Alkaline types are used, they should be removed immediately when they test low, to prevent instrument damage from battery leakage.

FLASHLIGHT SIZE "C" BATTERIES

Type	Neda	Burgess	Eveready	Mallory	RCA	Ray-O-Vac
Zinc-Carbon	14F	1	935	M14F	VS035A	1C
Alkaline	14A	ALI	E93	Mn1400	VS1335	814

RECHARGEABLE BATTERIES

Type	Burgess	Eveready	General Electric	Gould	Gulton
Ni-Cad	CD-14	CH 1.5	GCT 1.5 SB	2.0 SC	R-190

OHMS PROTECTION RESISTOR REPLACEMENT

Should this part require replacement due to accidental application to a power source in the 100Ω or 1000Ω range, R15 (Fig. 5) must be replaced. If the reading of a known 820Ω to 1000Ω resistor is very low on the 1000Ω range and the unit has been accidentally connected to high voltage, R15 should be replaced.

For proper operation, replace R15 with the proper DYNASCAN part shown on the parts list.

The instrument can be temporarily returned to service by substitution of a resistor value from 3.3k to 3.9k, 1/4W thru 1/2W. The substitute part will not give the same protection characteristics; therefore, it is recommended that the proper part be ordered to restore the original protection characteristics.

Procedure for R15 fusible resistor replacement (refer to Figs. 3, 4 and 5):

(1) Loosen captive screw and remove rear cover.

(2) Remove batteries.

(3) Unsolder the + jack from the P.C. board through access hole below.

(4) Remove 4 screws on bottom of housing and remove top cover.

(5) Remove knobs and lift shield clear of unit.

(6) Remove 1 screw (#2, Fig. 5) below the middle digit.

(7) In the battery pack, squeeze the battery terminals from P.C.B. at (#3, Fig. 5) and move P.C.B. up and far enough to gain access to R15.

(8) R15 is located at the top left side of the bottom P.C. board mounted in two standing terminals. Cut R15 out and solder replacement to terminals.

(9) For re-assembly, reverse the above steps.

If the Maintenance and Calibration procedures do not restore proper operation, pack the unit securely in its original carton and mail to the nearest B & K Precision authorized service agency. Refer to Warranty Service Instructions at the end of manual.

WARRANTY SERVICE INSTRUCTIONS

1. Refer to the maintenance section of the instruction manual for adjustments that may be applicable.
2. Check common electronics parts. Always check instruction manual for applicable adjustments after such replacement.
3. Defective parts removed from units which are within the warranty period should be sent to the factory, prepaid, with model and serial number of product from which removed, and date of product purchase.
4. If the above-mentioned procedures do not correct the difficulty, pack the product securely (preferably double packed). A detailed list of troubles encountered must be enclosed as well as your name and address. Forward prepaid (express preferred) to the nearest B&K-Precision authorized service agency.

Contact your local B&K-Precision Distributor for the name and location of your nearest service agency, or write to

Service Department
B&K-PRECISION DIVISION OF DYNASCAN CORP.
2815 W. Irving Park Rd.
Chicago, Illinois 60618

B+K PRECISION

DYNASCAN CORPORATION

1801 West Belle Plaine Avenue, Chicago, Illinois 60613

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